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ABSTRACT

Evaluated was the use of the Azusa developmental scale with 16 deaf blind children in a completed study and 124 deaf blind children in an ongoing study to determine the scale's usefulness for objective evaluation of behavior change, instructional planning, and program evaluation. The children in the first study were rated on the performance objectives before and after 7 months of program participation. Scores were compared with normal developmental norms for nonhandicapped children. The scale evaluated the following areas: socialization, daily living skills, motor development, perceptual abilities, and language development. Greatest mean progress tended to occur in perceptual abilities (15 months) and socialization (14 months) while least progress was made in language development (9 months). Eating and toileting skills showed the greatest progress among areas of daily living skills. In the motor development section greater progress was found for fine motor control than for gross motor skills which were at a higher level at both pretesting and posttesting. The children in the program progressed at a rate greater than would be expected from normally developing children suggesting that the handicapped children are "catching up" to their normally developing peers. Results of the second study should provide more complete data on subgroups of deaf blind children. The Azusa scale was found to be appropriate for measuring developmental progress, improving instruction, and evaluating programs for deaf blind children. (DB)

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Measuring Progress in Deaf-Blind Children: Use of the "Azusa Scale"

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INTRODUCTION

Evaluation of the effectiveness of educational, rehabilitative, and therapeutic programs for deaf-blind children has been hampered by the lack of a simple, accurate, and quantifiable means of documenting behavior change. Present methods of assessing change (behavior checklists, video-taped activity protocols) are often inconvenient, difficult to interpret, and difficult to quantify. On the other hand, traditional standardized tests for measuring functioning level of handicapped children are inappropriate since they fail to take into account the profound sensory, motor, integrative, and communicative disorders characteristic of most deaf-blind children.

The purpose of this study was to determine an objective means of measuring behavior change in deaf-blind children. It was hoped that information gained from such evaluations would reveal areas where progress can be made and the extent of progress to be expected. It was also hoped that the study would provide insights into the pattern of deficits exhibited by deaf-blind children. These insights might, in turn, lead to the design of more effective educational and rehabilitative programs.

It was decided to measure progress in deaf-blind children by comparing the rate of development among these children to the normal rate of development. This approach was considered most appropriate since

development in deaf-blind children was viewed as delayed and the primary construct of the program was to encourage growth according to normal developmental sequences.

The developmental scale used in this study to measure progress was the "Azusa Scale" developed at the East San Gabriel Valley School for Multihandicapped Children in Azusa, California. The Azusa Scale (Appendix 1) is a developmental checklist encompassing five areas of behavior: Socialization, Daily Living Skills, Motor Development, Perceptual Abilities, and Language Development. Within each of the five behavior areas (subscales) are four performance objectives made up of six temporally sequential steps describing specific aspects of behavior leading to acquisition of the particular performance objective. Each step describes behaviors observed among both normal and multihandicapped children.

The Azusa Scale was designed for use as a teaching aid in planning developmentally appropriate programs,as a tool for measuring subsequent behavioral changes, and as an evaluative device for measurement of the overall effectiveness of a program of services. This scale is particularly useful because it is concise, easy to administer, and simple to score.

behavior repertoire. The teachers were specifically instructed not to consider a level achieved if the behaviors were emerging, occurred rarely, or had to be elicited by the teacher.

In administering the post-test, it was not possible to control for the teachers' knowledge of the pre-test scores. However, since the Azusa Scale ratings formed the basis for program planning for individual children, it was reasonable to assume that the ratings were accurate. In addition, no pressure was placed on the teachers to demonstrate progress, and they were unaware that the ratings would be used for purposes other than their own program planning.

Data Analysis

Data obtained with respect to level of functioning on the pre- and post-tests were converted to age equivalency scores for further analysis. A change from scale level to age equivalency scores was necessitated by the fact that movement from one level to the next did not reflect equal changes either with respect to difficulty or to the time interval normally occurring between attainment of one group of abilities and the next. Without some means of equating the data both within and between subscales, it was felt that it would be difficult to draw inferences from the results.

The age equivalencies used were provided with the Azusa Scale and were based on normative data (Gesell) indicating the chronological age at which the behavior appears. For consistency in scoring, when an age range was given on the Azusa Scale, the age equivalency assigned was the minimum age.

METHODS

Callier Study

Subjects

Sixteen deaf-blind children (11 boys and 5 girls) enrolled in the Callier Hearing and Speech Center Deaf-Blind Program in 1971-72 were subjects in this study. The ages of the children ranged from 1 to 13 years (mean age 7 years) but 7 of the children were between the ages of 6 and 7½.

Test Administration

Each child was rated on the twenty Azusa Scale performance objectives upon entry into the program (pre-test) and at the end of the school year (post-test). The inter-test interval was 8 months for 12 children but less for 4 children who entered the program after the school year had begun.

The Azusa Scales were administered by the program teaching staff. Pre-test ratings were made by the entire teaching staff on a consensus basis and comprised part of the child's initial staffing. Post-test ratings were made on a consensus basis by the three teachers most familiar with the individual child's behavior. Ratings were based on personal observations, interactions with the child, and video-taped records obtained during the child's initial and year-end evaluations.

In rating each child, the teachers were instructed to score a child at a given level only if the behaviors defining the level occurred spontaneously or could be considered integrated components of the child's

In addition to the age equivalencies determined for each performance objective, mean age equivalencies were calculated for each of the five subscales. Mean pre- and post-test age equivalency scores across the five subscales were also calculated producing the overall means for each child.

It was felt that calculating mean age equivalencies was justified since the performance objectives were designed to encompass all important aspects of behavior. However, in calculating these means, the assumption was made that each performance objective is equally important in a child's overall development. Whether this assumption is valid is not known. However, the rankings of the children with respect to mean age equivalency scores agreed with the teachers' subjective rankings of the children based upon their impressions of the childrens' behavior.

Performance objective 4.4 (olfactory and gustatory discriminations) was not included in any of the calculations since this particular aspect of behavior has no documented developmental age norms. Mean age equivalencies for Perceptual Abilities were, therefore, determined on the basis of the remaining three performance objectives. In calculating overall mean age equivalencies, the five subscale scores were averaged, thus weighing all subscales approximately equally in determining overall mean age equivalency scores.

Subjects

In August, 1972, Azusa Scales were distributed to all of the deaf-blind programs in Arkansas, Louisiana, Oklahoma, and Texas. Completed responses were returned by 11 programs and usable Azusa Scale profiles were obtained from 124 deaf-blind children. The following is a breakdown of subjects and mean chronological ages (in months) for the children included in the study.

Program	Number	Mean Chronological Age (Months)
Arkansas Children's Colony	10	195
Arkansas School for the Blind	3	
Austin Cerebral Palsy Center	8	62
Baton Rouge	6	113
Callier Hearing and Speech Center	20*	83
Hissom Memorial Center	3	
New Orleans	2	
Oklahoma City Child Study Center	12	62
Pinecrest State School	37	115

* The children in the Callier Program during Fall, 1972, differ somewhat from those studied during the 1971-72 school year.

In addition, Azusa Scale profiles were obtained from 9 "learning impaired" deaf children at the Callier Hearing and Speech Center (mean age: 55 months) and from 32 normal children (mean age: 28 months) at the American Association of University Women Child Development Center, a nursery school program in Dallas.

Test Administration

Instructions for test administration were essentially the same for the Regional Study as for the Callier Study. However, only pre-test data are currently available regionally. The profiles for the Regional Study were completed, in general, by the one or two teachers most familiar with the child.

Data Analysis

Mean age equivalency scores were calculated in the same manner as previously described for the Callier Study.

RESULTS

Callier Study

Evaluation of Developmental Change Among Individual Children

Figures 1-2 are typical examples of individual Azusa Scale profiles for deaf-blind children. Performance objectives (1.1-5.4) are listed on the abscissa and developmental level on the ordinate. The numbers next to each point on the profile are the appropriate age equivalency scores for normal development in months.

The differences in pre- and post-test age equivalency scores (Figures 1-2) show the developmental changes in specific behavior areas (performance objectives) during the inter-test interval. Figure 1 indicates that this particular child progressed considerably in responding to (1.2) and cooperating with (1.4) others, in washing (2.2), feeding (2.3), mobility skills (3.4) and in the development of memory and inner language (5.1). Little or no progress was observed in other areas of behavior.

Overall mean age equivalency scores indicate that 10 months of progress was made during the 8 month inter-test interval (Overall Mean). With respect to individual subscales (pre-test scores precede and post-test scores follow the arrow), it appears that most progress was made in Motor Development while almost none occurred in Perceptual Abilities.

The profile in Figure 2 indicates that another child made exceptional gains in Daily Living Skills and Perceptual Abilities but more modest growth in other areas.

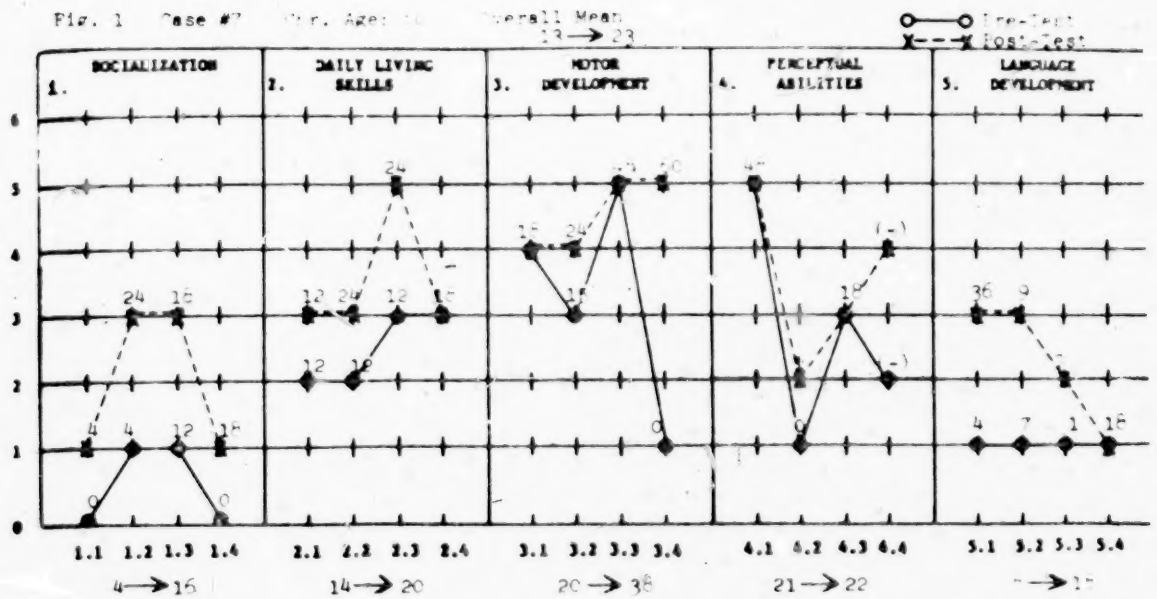


Fig. 1 Case #7 Chr. Age: [illegible] Overall Mean [illegible] → 23

4 → 16 14 → 20 20 → 38 21 → 22 [illegible] → 17

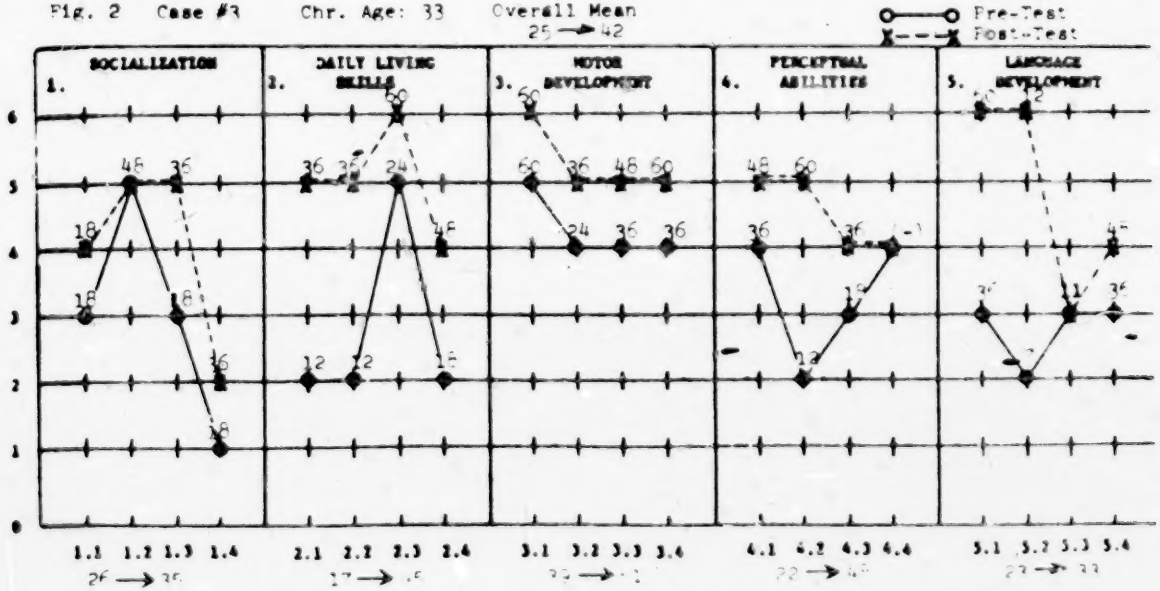
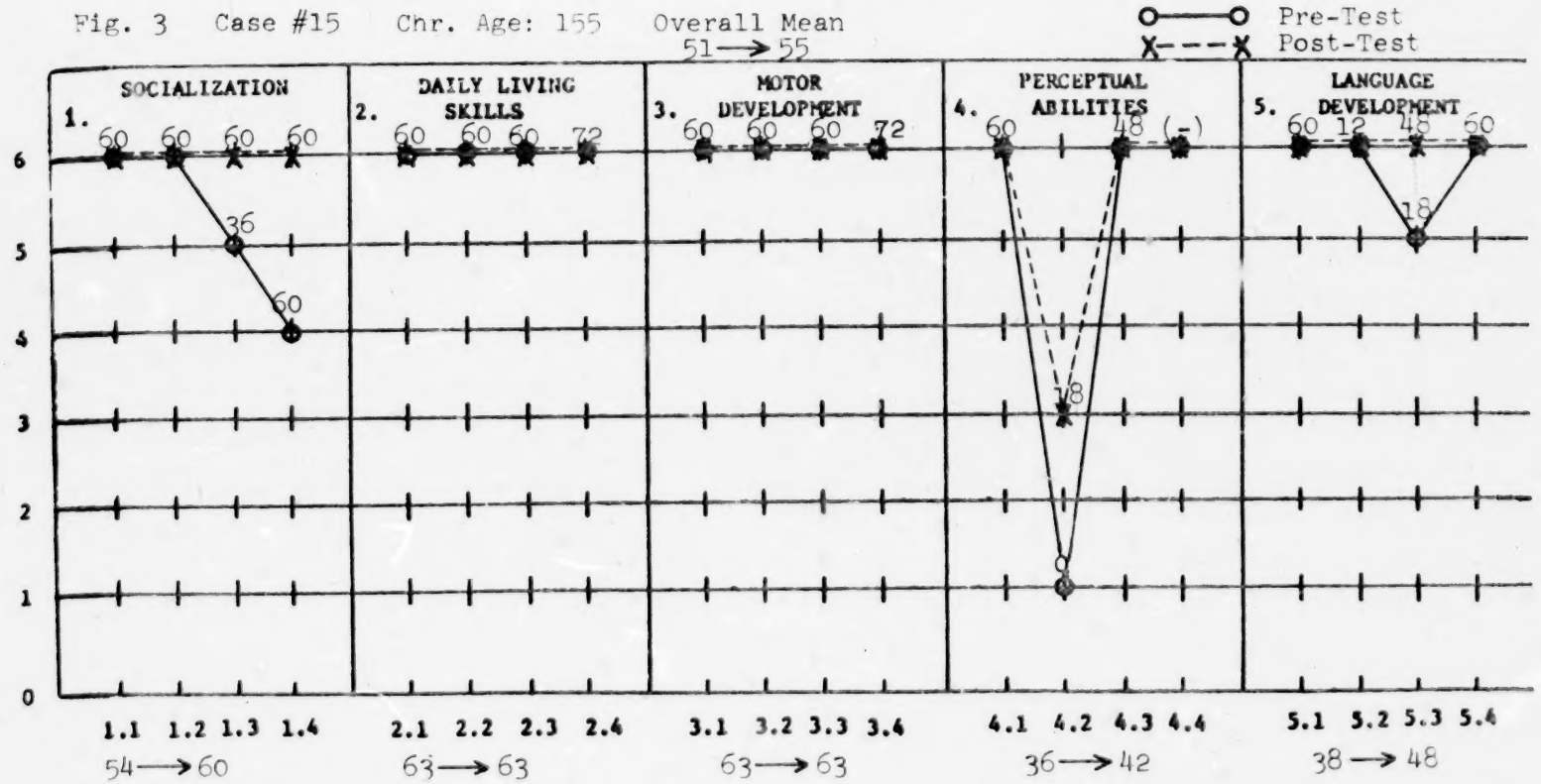


Fig. 2 Case #3 Chr. Age: 33 Overall Mean 25 → 42

26 → 36 17 → 46 [illegible] → 1 22 → 48 22 → 33

Fig. 3 Case #15 Chr. Age: 155 Overall Mean 51 → 55



A comparison of the two Azusa Scale profiles indicate that Child #3 (Figure 2) functioned at a higher developmental level and made greater progress overall than Child #7 (Figure 1). These differences in overall progress, however, can be related to a great extent to the marked differences between the children in progress in Perceptual Abilities and Daily Living Skills. Examination of the results on individual performance objectives indicates that in some areas Child #7 (Figure 1) made more progress than Child #3 (Figure 2).

Mean age equivalency scores as shown in Figures 1 and 2 are of value in briefly and quantitatively summarizing changes in the child's functioning level. However, caution must be exercised in interpreting mean score since they are not directly relatable to normal development at the same chronological age. Thus, the mean age equivalency score of 16 months on Socialization (Figure 1) does not necessarily mean that this child's socialization abilities are characteristic of a 16 month old.

The lack of correspondence between mean age equivalency scores and developmental age may be accounted for by two factors. The first is the fragmentary nature of development often typical of deaf-blind children. For example, within the Socialization subscale (Figure 1), a developmental spread of 4 to 24 months exists at post-test on the four performance objectives. Second, the design of the scale is such that at higher developmental levels, there are fewer intervening steps. Thus, on some performance objectives a child functioning between the 36 and 60 month level must receive an age equivalency score of either 36 or 60. A change from one level to the next will thus tend to exaggerate both progress and the

apparent spread between age equivalency scores on the performance objective.

Another problem in interpreting mean age equivalency scores results from the age limitations of the scale. The maximum age equivalency score (Level 6) attainable on any performance objective is 72 months, and for most performance objectives, the maximum limit is somewhat lower. Since the chronological age of 75% of the children participating in this study is greater than 72 months, the abilities of some children in specific areas exceed the measuring capabilities of the test instrument. For example, the Azusa Scale profile shown in Figure 3 indicates that at pre-test, this child was rated at Level 6 in 16 of the 20 performance objectives. Thus, developmental progress could be measured only in the four remaining performance objectives. However, even these measures may not adequately reflect progress since Level 6 was reached at post-test in all but one performance objective.

However, despite the restrictions on interpretation of mean age-equivalency scores, these data do provide useful information. Table I shows the mean pre- and post-test age equivalency scores on the 5 subscales for 16 deaf-blind children. The asterisks indicate that the maximum score was achieved on the 4 performance objectives within the subscale. The scores in Table I show the heterogeniety of development among deaf-blind children. This heterogeniety is evident both between children on each subscale and within individual children across subscales. For example, the subscale indicating highest and lowest functioning level is to a large extent dependent upon the individual child. Likewise the age equivalency

TABLE I

---------- Azusa Subscale ----------

Sex Child	Pre-Test Chronological Age (Months)	Socialization	Daily Living Skills	Nocor Development	Perceptual Abilities	Language Development	Overall Mean	Progress (Months)	Test Interval (Months)
M 1	(12)	0→16	3→16	1→15	2→40	1→19	1→21	20	8
F 2	(30)	2→3	3→5	2→5	0→22	1→1	2→7	5	8
M 3	(33)	26→35	17→45	39→51	22→48	23→33	25→42	17	8
M 4	(56)	1→6	8→14	12→24	14→28	8→8	9→16	7	8
F 5	(69)	4→14	8→12	19→27	6→28	3→16	8→19	11	8
M 6	(70)	17→48	13→42	42→63*	32→48	23→33	25→47	22	8
F 7	(80)	4→16	14→20	20→38	21→22	8→18	13→23	10	8
M 8	(80)	9→23	23→42	57→57	32→32	18→23	28→35	7	8
M 9	(81)	18→42	12→29	26→35	24→28	17→29	19→33	14	8
M 10	(81)	2→15	13→28	27→63*	26→32	15→17	16→31	15	8
M 11	(88)	42→60*	63*→63*	63*→63*	32→56	28→38	46→56	10	2
M 12	(110)	33→60*	39→44	54→60	48→60*	23→45	39→54	15	8
M 13	(122)	2→9	3→10	6→7	6→19	1→5	4→10	6	4
F 14	(124)	5→14	12→15	15→31	2→16	7→9	8→17	9	8
M 15	(156)	54→60*	63*→63*	63*→63*	36→42	38→48*	51→55	4	7
F 16	(159)	44→60*	63*→63*	63*→63*	36→60*	29→38	47→57	10	4
Mean (1)		16→30	22→32	32→42	21→36	15→24	21→33	12	7
Mean (2)			13→25	25→37					
Difference		14 mo.	12 mo.	12 mo.	15 mo.	9 mo.			

scores on each subscale indicate a wide spread both within and between children.

Heterogeniety with respect to the area of greatest and least developmental progress during the school year is demonstrated in Table II. This table shows the particular subscale where the children exhibited maximum and minimum development. Results from three children (Numbers 11, 15, and 16) were not included in this table since they received maximum scores on two subscales in the pre-test. Table II provides evidence that maximum or minimum developmental advancement can occur in almost any area, although in Language Development, nearly half the children exhibited minimum and none maximum developmental progress.

More extensive analysis of results on individual children will not be reported here since such information is primarily of interest to the individual child's teacher, and a detailed analysis can be adequately made only with considerable supplementary information. However, the mean data for the Callier Program will be explored since it has bearing on the effectiveness of the total program of services.

Evaluation of Program Effectiveness

The following provides evidence from Azusa Scale data concerning the strengths, weaknesses, and overall effectiveness of the Callier Deaf-Blind Program.

Mean (1) (Table I) shows mean pre- and post-test age equivalency scores on each subscale for the 16 deaf-blind children. Mean (2) is a corrected mean for Daily Living Skills and Motor Development which excludes data on

TABLE II

Number of Children Showing Maximum and Minimum Progress on Each Subscale

MAXIMUM PROGRESS

Subscale

Soc.	D.L.S.	Mot.	Perc.	Lang.
3	2	3	5	0

MINIMUM PROGRESS

Subscale

Soc.	D.L.S.	Mot.	Perc.	Lang.
0	3	1	3	6

the three children who achieved maximum scores in the pre-test in these subscales. Means (1) and (2) indicate that exceptional progress was made by the group particularly in the areas of perceptual abilities and socialization while somewhat less growth took place in the development of language. Using the more conservative Mean (1), the results show that an average 12 months developmental progress in the average 7 month interval between the pre- and post-tests. This suggests that overall the children in the Callier Program made progress at a rate exceeding that which might be expected among unimpaired children.

In order to determine the areas of behavior where greatest and least progress occurred, mean age equivalency scores on the subscales were broken down into mean scores on each performance objective. These results are presented in Figure 4 and Table III.

Mean performance objective scores provide information concerning the extent of developmental progress in particular areas as well as a profile of the abilities and handicaps of these children. For example, in Socialization, almost equal progress was made in all performance objectives. However, the children tended to be rated highest in responding to others (1.2), but somewhat lower in skills involving interpersonal interactions or cooperation (1.3, 1.4).

In Daily Living Skills, the results appear to reflect the emphasis of the Callier Program on the acquisition of feeding skills. A mean 13 months progress was made with respect to this performance objective. Toileting skills (2.4), also emphasized within the program, showed marked progress. Less time, however, was devoted to training in dressing (2.1)

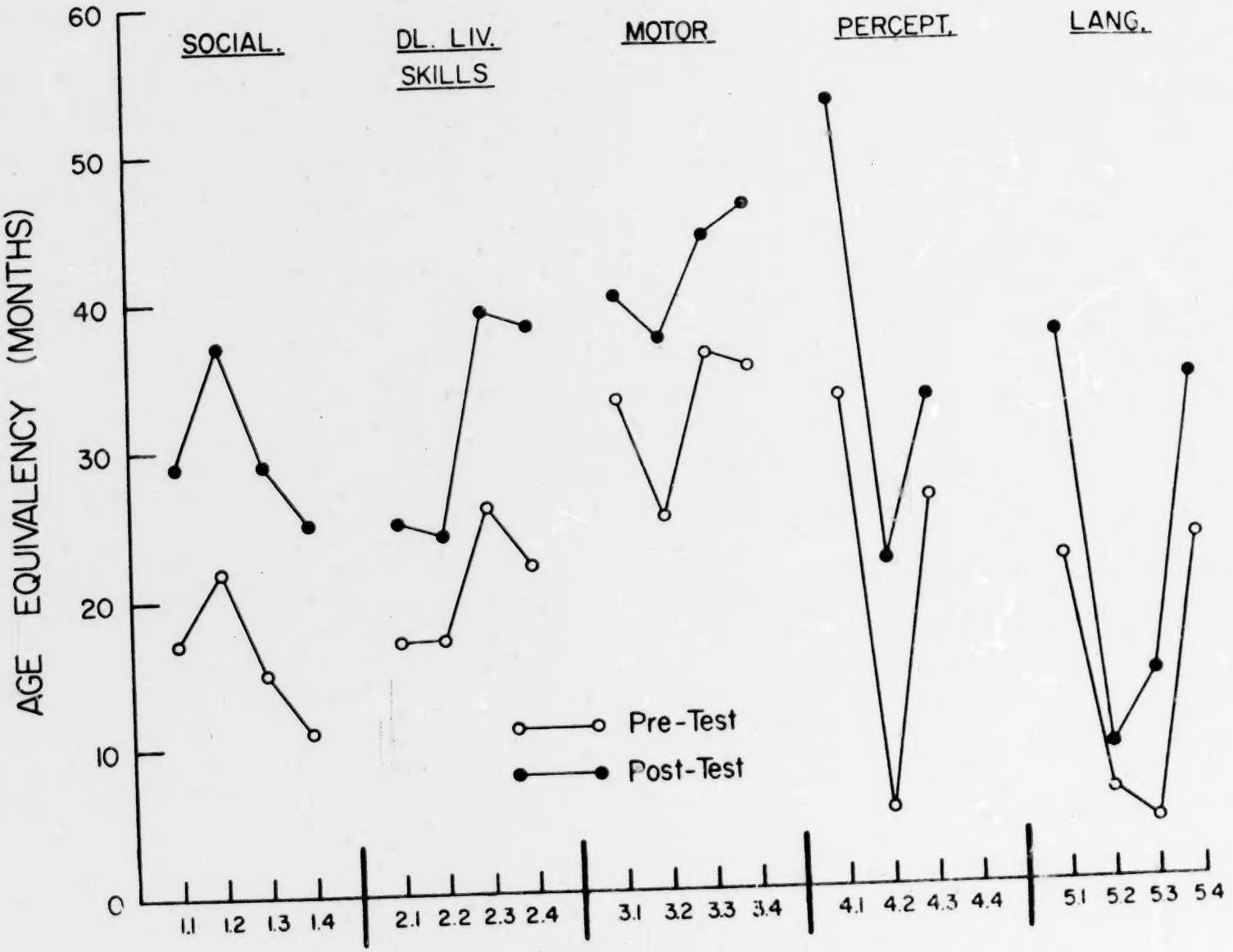

SOCIAL.
DL. LIV. SKILLS
MOTOR
PERCEPT.
LANG.
AGE EQUIVALENCY (MONTHS)
60
50
40
30
20
10
0
Pre-Test
Post-Test
1.1 1.2 1.3 1.4
2.1 2.2 2.3 2.4
3.1 3.2 3.3 3.4
4.1 4.2 4.3 4.4
5.1 5.2 5.3 5.4
PERFORMANCE OBJECTIVE

Fig. 4

TABLE III

Pre- and Post-Test Mean Age Equivalency
Scores on Individual Performance Objectives

SOCIALIZATION

1.1 Developing self-identification

17 ⟶ 29

1.2 Responding to adults, children, and objects

22 ⟶ 37

1.3 Interacting with others

15 ⟶ 29

1.4 Cooperating with others

11 ⟶ 25

Mean

16 ⟶ 30

DAILY LIVING SKILLS

2.1 Undressing and dressing

17 ⟶ 25

2.2 Washing hands and face

17 ⟶ 24

2.3 Eating solid foods, using utensils and drinking cups

26 ⟶ 39

2.4 Toileting

26 ⟶ 38

Mean

22 ⟶ 32

TABLE III--Continued

MOTOR DEVELOPMENT

3.1 Performing gross body movements in place

33 ---> 40

3.2 Performing fine, manipulative movements

25 ---> 37

3.3 Performing locomotor activities

36 ---> 44

3.4 Moving in space and sensing spatial relationships

35 ---> 46

Mean

32 ---> 42

PERCEPTUAL ABILITIES

4.1 Recognizing, accepting and initiating tactile stimuli

33 ---> 53

4.2 Attending, discriminating and responding to auditory stimuli

5 ---> 22

4.3 Attending, discriminating and responding to visual stimuli

26 ---> 33

4.4 Identifying and discriminating between odors, and between food tastes

(-) (-)

Mean

21 ---> 36

TABLE III--Continued

LANGUAGE DEVELOPMENT

5.1 Developing memory and functions of inner language

22 ---> 37

5.2 Developing perception and functions of receptive langu ge

6 ---> 9

5.3 Developing functional communication in expressive language

4 ---> 14

5.4 Developing conceptualization through communication

23 ---> 34

Mean

15 ---> 24

and washing (2.2) and the least progress was observed in these areas.

Results on Motor Development indicate that these children were closer to age level in gross motor activities (3.1, 3.3, 3.4) than in fine, manipulative movements (3.2). Progress in fine motor activities, however, occurred at a more rapid rate during the inter-test interval than did development of gross motor skills.

In Perceptual Abilities, it appears that these children are most competent in the use of tactile stimuli (4.1) and least competent in the use of sounds (4.2). The higher ratings on tactile usage are expected since this sense is presumably unimpaired. However, the extremely low scores in audition (4.2) even relative to vision (4.3) suggest that these children are making minimal use of residual hearing.

Greatest progress in Perceptual Abilities was made in tactile usage. This, in part, results from the performance objective (4.1) items which weight acceptance of novel food textures highly. Since the program emphasized developing feeding skills, it is not surprising that tactile acceptance improved considerably. Use of auditory stimuli (4.2) also improved markedly, probably reflecting both concentration on auditory training and the extremely low pretest scores. Visual efficiency (4.3) improved only moderately, possibly because the requirement of vision for mobility had all along resulted in maximal use of residual vision.

Results on Language Development suggest that aspects of language development requiring active involvement with others, for example, expressive and receptive language (5.2 and 5.3), are at a lower level and progress at a slower rate than memory, inner language, and conceptualization (5.1 and 5.4) which can occur relatively independent of others. These data parallel findings on the Socialization subscale where the children scored higher in simply responding to others (1.2) than in interacting or cooperating with them (1.3, 1.4). It should be noted, however, that the maximum age equivalency score on the receptive language performance objective (5.2) is only 12 months. Thus, the mean score is probably artifically depressed. Nonetheless, only three children in the pre-test and five children in the post-test (see Table V) achieved Level 6 on this performance objective. Therefore, it may be assumed that among these children receptive language is, in general, at a very low level.

Documentation of developmental progress among children in the program can be made in another way. Table IV shows the number of children who scored at the lowest level (Level "0") on each of the performance objectives. It can be seen that in the pre-test, 20% (61 out of 304) of the scores were at the minimum level while only 6% (18 out of 304) of the post-test scores were at the minimum level. These findings indicate the success of the program in initiating growth among children functioning at the lowest developmental levels. Using this measure, success was most noticeable in Socialization,

TABLE IV

Number of Children Receiving Minimum Scores in the Pre- and Post Tests.

	PERFORMANCE OBJECTIVES				Total
Socialization	1.1 7→1	1.2 1→0	1.3 5→1	1.4 10→6	23→8
Daily Living Skills	2.1 0→0	2.2 2→0	2.3 0→0	2.4 3→1	5→1
Motor Development	3.2 2→0	3.2 0→0	3.3 1→0	3.4 2→0	5→0
Perceptual Abilities	4.1 2→0	4.2 6→3	4.3 2→1	4.4 3→0	13→4
Language Development	5.1 1→0	5.2 4→2	5.3 5→1	5.4 5→2	15→5
Entire Profile ---					61→18

followed by Perceptual Abilities and Language Development.

Table V presents data which may be interpreted to show program success in encouraging growth among children at the highest developmental level. On the pre-test, 18% (54 of 304) of the items were scored at Level 6 while on the post-test, 38% (101 of 304) were scored at Level 6. The subscale on which the greatest increase in Level 6 scores occurred was again Socialization while the greatest total number of Level 6 scores were found in Motor Development.

The figures and tables presented all indicate that distinct developmental progress was made by most children in the Callier Program. However, in the absence of a control group of deaf-blind children who received no services, establishment of relationships between participation in the Callier Program and developmental progress must be made indirectly.

The following evidence suggests that developmental progress among the children is related to participation in the Callier Program. First, development in nearly all areas among most children prior to entry into the Callier Program was markedly delayed. However, in the course of a school year, overall development took place at a rate greater than normal (greater Months Progress than Test Interval, Table I) for 12 of the 16 participating children. This sudden onset of growth cannot be attributed solely to the child's attendance in a program since many of the children were receiving services prior to the establishment of a deaf-blind

TABLE V

Number of Children Receiving Maximum Scores in the Pre- and Post Tests.

	PERFORMANCE OBJECTIVES				Total
Socialization	1.1 2→5	1.2 2→5	1.3 1→4	1.4 0→4	5→18
Daily Living Skills	2.1 3→3	2.2 3→6	2.3 4→6	2.4 3→6	13→21
Motor Development	3.1 3→6	3.2 3→6	3.3 4→6	3.4 5→7	15→25
Perceptual Abilities	4.1 5→7	4.2 0→2	4.3 4→5	4.4 5→6	14→20
Language Development	5.1 1→6	5.2 3→5	5.3 0→2	5.4 3→4	7→17
Entire Profile ---					54→101

program at Callier. In addition, the significant growth occurring among both the lower and higher functioning level children (Tables IV and V) suggests that the overall development increases were not due simply to raising the functioning level of the lowest children, those for whom exposure to even a minimum of services might be expected to result in some initial gains.

The extent of progress among the children was, in fact, related to the actual number of days in attendance in the program. Table VI shows the ranking of the children with respect to Months Progress (Table I) and number of days attending the program. A Spearman Rank Order Correlation performed on the data yielded a correlation coefficient of .474 between the two rankings. This suggests that frequency of attendance determines, at least, in part, the extent of development made.

Finally, results on the overall means for performance objectives (Table III) shows that distinct progress occurred in feeding, toileting, auditory training and socialization, areas which received primary emphasis in programming for individual children. This again indicates that the Callier Program had an impact on the developmental change in the children and that progress would be less clear and, in fact, might not have occurred in the absence of the program.

TABLE VI

Rank Order of Children with Respect to Progress and Attendance in the Program

Child	Progress	Attendance
6	1	4
1	2	7
3	3	8.5
12	4.5	1
10	4.5	2
9	6	6
5	7	11
7	8	10
14	9	3
4	10.5	5
8	10.5	13
15	12.5	8.5
2	12.5	12

Spearman rank order correlation coefficient = .474

Note: Only children in attendance in the program at least seven months a e included in the rankings.

Regional Study

The regional studies are still in progress and will not be completed until data from the May, 1973, re-evaluations of the children are available and analyzed. It is, however, of value to present preliminary results which reveal general characteristics of the children served within each program and provide evidence concerning the validity of the Azusa Scale both as a descriptive device and as a tool for measuring progress in deaf-blind children.

Figures 5 and 6 show mean age equivalencies on Azusa Scale performance objectives for six programs. Each data point in the figures is a mean of 8 to 37 children (see Methods).

Examination of the program profiles indicates similarities between programs on all subscales. In Socialization, with the exception of one program, the children were at a higher level in responding to other (1.2) than in interacting (1.3) or cooperating (1.4). Development of self-identification (1.1), possibly a critical factor in motor development as well as socialization, was also low.

Results in Daily Living Skills appear to reflect the emphasis of the various programs on attaining these particular abilities. For example, the mean age equivalency for toileting (2.4) was generally highest possibly due to the importance placed on acquisition of this skill. However, the Callier Program which stressed the development of feeding skills (2.3) was an exception. In this program, feeding skills showed the highest scores. Dressing (2.1) and washing (2.2),

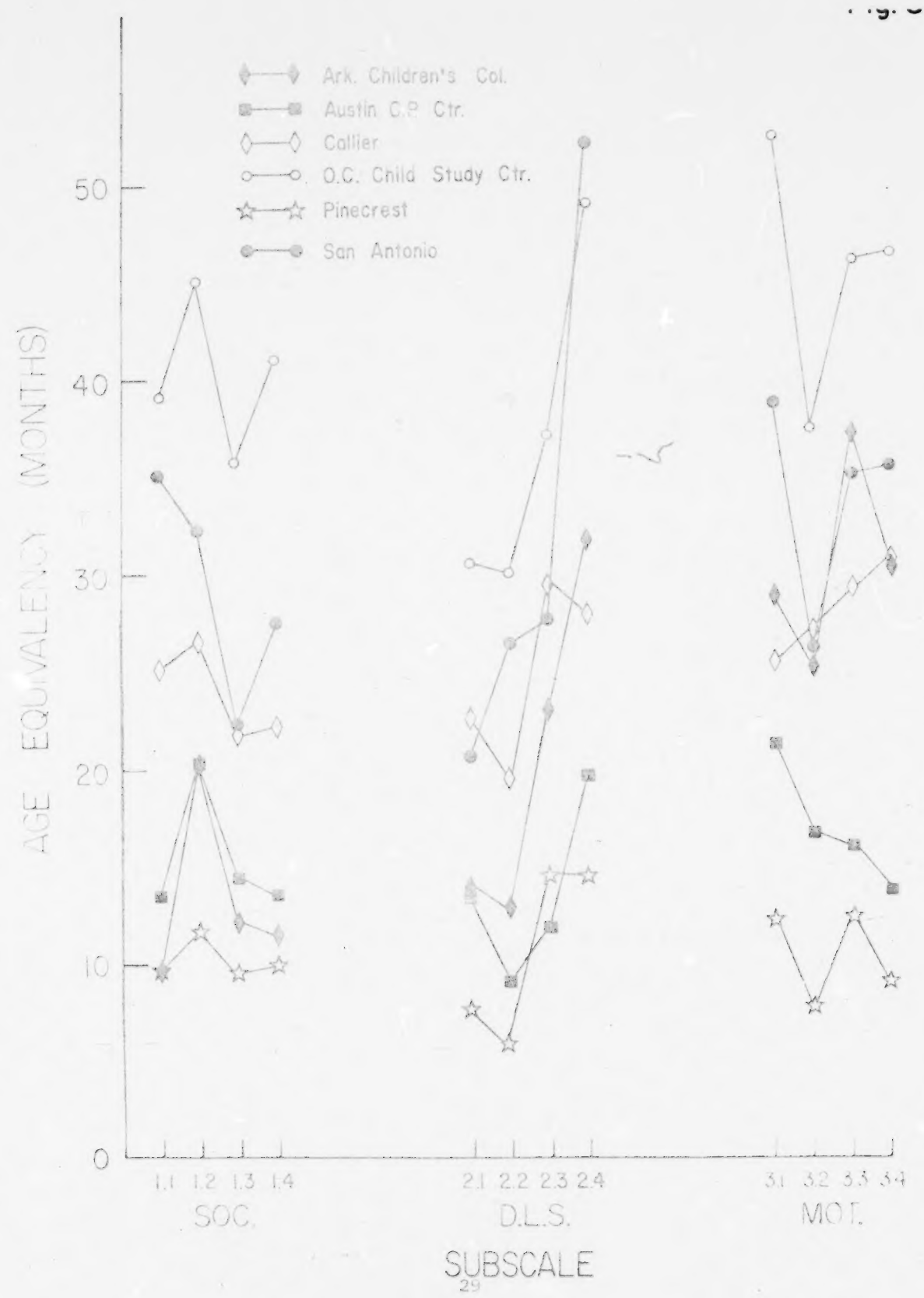
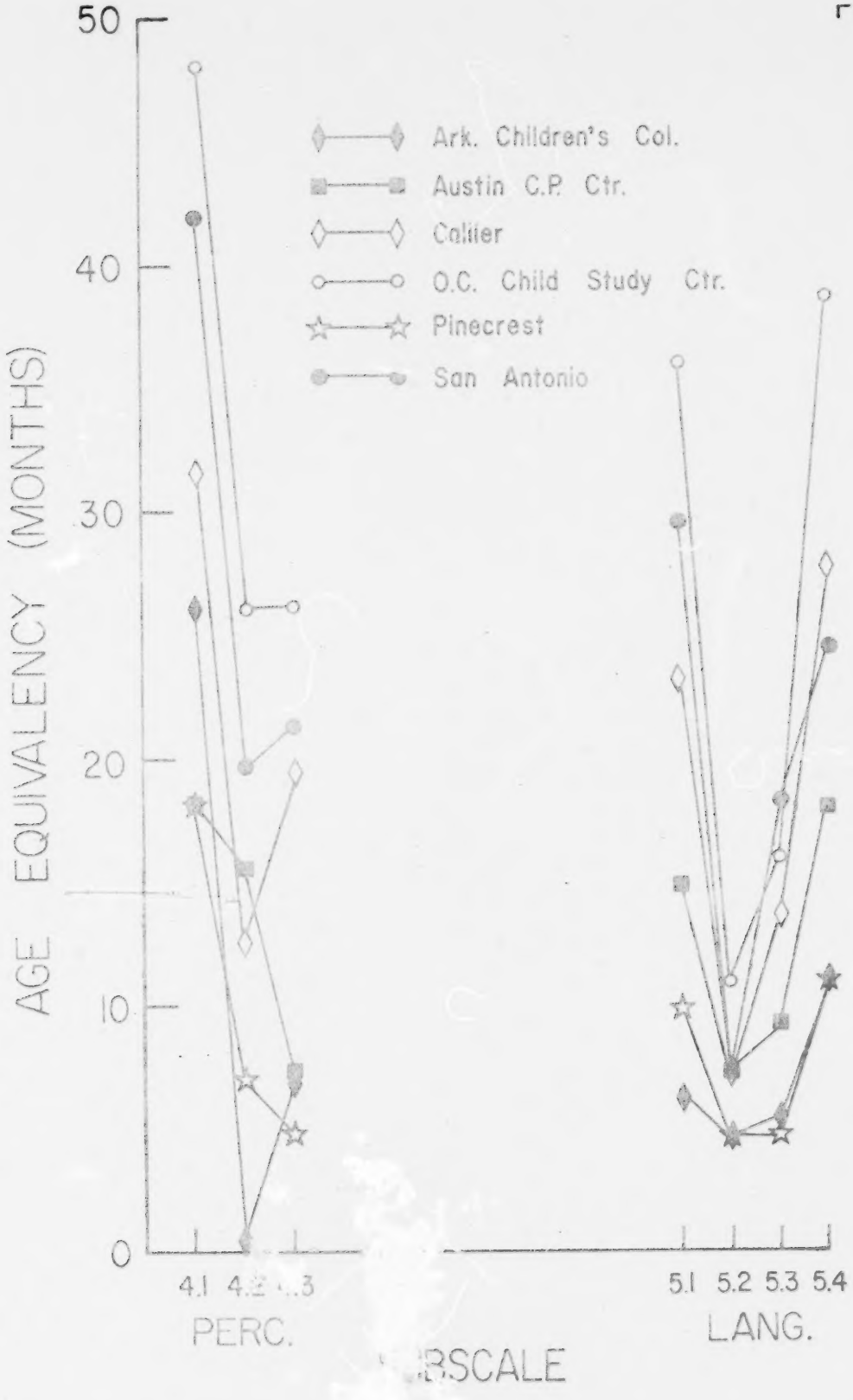

Ark. Children's Col.
Austin C.P. Ctr.
Callier
O.C. Child Study Ctr.
Pinecrest
San Antonio
AGE EQUIVALENCY (MONTHS)
0
10
20
30
40
50
1.1 1.2 1.3 1.4
2.1 2.2 2.3 2.4
3.1 3.2 3.3 3.4
SOC.
D.L.S.
MOT.
SUBSCALE

Fig. 6


50
40
30
20
10
0
AGE EQUIVALENCY (MONTHS)
Ark. Children's Col.
Austin C.P. Ctr.
Caliier
O.C. Child Study Ctr.
Pinecrest
San Antonio
4.1 4.2 4.3
PERC.
5.1 5.2 5.3 5.4
LANG.
RSCALE

which are usually deemed of lesser importance to child, teacher, and parent, uniformly received the lowest scores.

Motor Development scores presented the greatest inter-program variability. The reasons for this are not known, although it may reflect the frequency of occurrence and severity of orthopedic and neuromuscular disabilities among children in the individual programs. It does appear, however, that deaf-blind children are at a lower level in fine motor control and usage (3.2) than gross motor skills (3.2, 3.3, 3.4).

Results on Perceptual Abilities show highest functioning in tactile abilities (4.1) in spite of the frequently described occurrence of tactile resistance and defensiveness. Use of the auditory sense (4.2) was lower than use of vision (4.3) in four programs, but in two programs, use of vision was lowest.

In Language Development, similar profiles were seen for all six programs. In each case, receptive (5.2) and expressive (5.3) language, areas requiring direct interaction with others, were low while memory and inner language (5.1) and conceptualization (5.4), areas not requiring inter-personal interaction, were relatively high.

Differences between programs appear to be primarily related to differences in overall level of functioning. The relative position of the mean scores from each program are roughly the same across the five subscales. These differences in overall functioning probably reflect both the extent of handicaps and prior exposure of the children to intensive educational and rehabilitative programs.

It must also be taken into account that some differences between programs may reflect different strategies in administering the Azusa Scale. However, it is believed that the instructions were sufficiently explicit to rule this out. In addition, teachers from the Callier Program who were familiar with the use of the Azusa Scale aided teachers in other programs in administering the scale.

The Azusa Scale was also administered to unimpaired nursery school children and a group who were best defined as "learning impaired" deaf children. This study was conducted to determine roughly how children other than deaf-blind would be rated. These results provide useful, although tentative information relevant to the interpretation of mean Azusa Scale profiles.

Mean performance objective scores from normal, hearing impaired, and the total sample of deaf-blind children are shown in Figure 7. These profiles are somewhat similar in configuration, a finding with two possible interpretations. One interpretation is that the similarities indicate that in the areas of behavior covered on the Azusa Scale, deaf-blind, hearing impaired, and normal children develop similarly, the primary difference between the groups being developmental delay roughly estimated by subtracting mean age equivalency score from mean chronological age. The second interpretation, however, is that similarities are due to deficiencies in test construction or in the manner of assigning age equivalencies which result in certain performance objectives tending to receive high or low ratings.

It is not yet possible to determine which alternative is most critical. However, close examination of the data suggests that

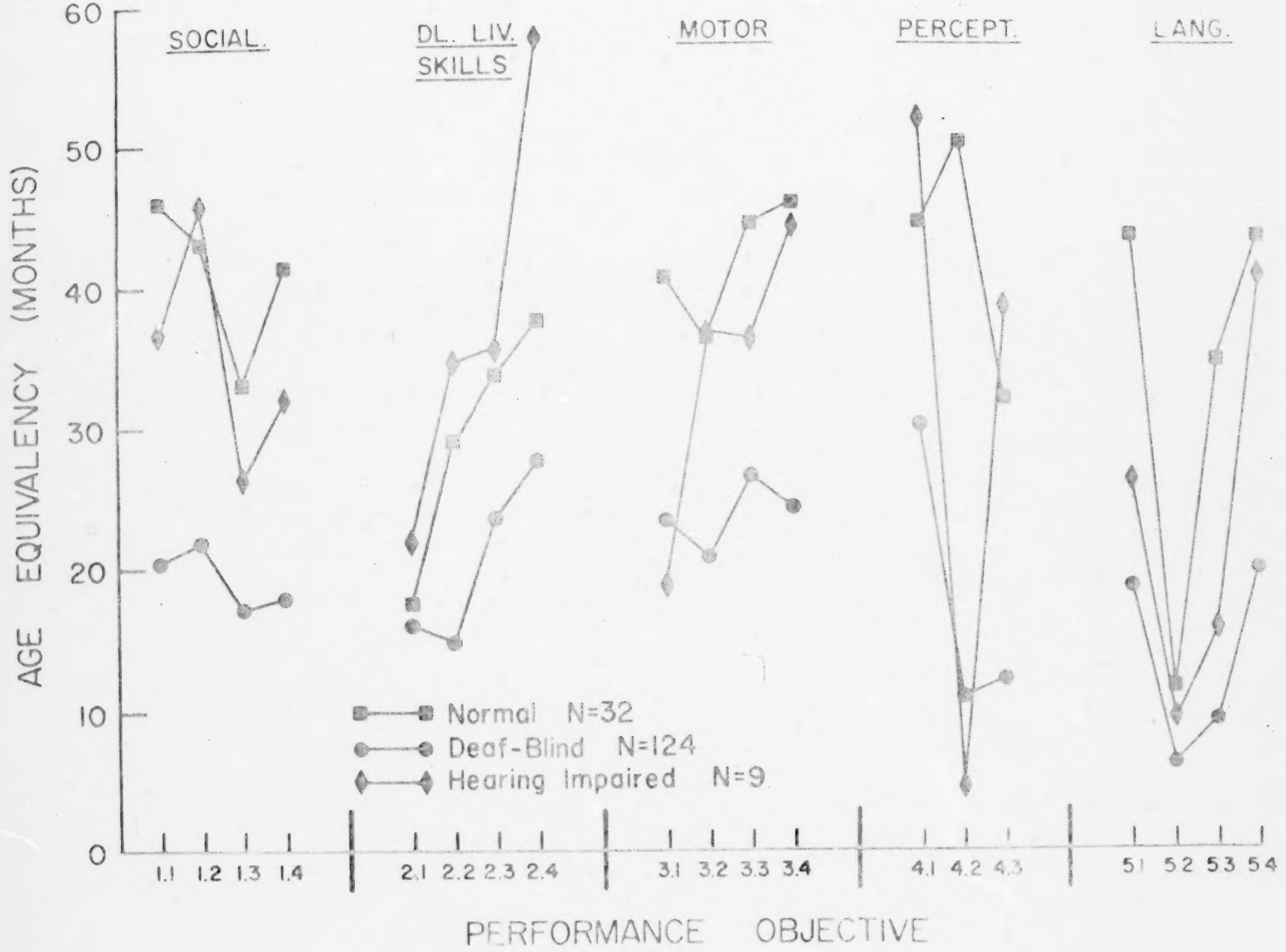

SOCIAL.
DL. LIV. SKILLS
MOTOR
PERCEPT.
LANG.
AGE EQUIVALENCY (MONTHS)
60
50
40
30
20
10
0
Normal N=32
Deaf-Blind N=124
Hearing Impaired N=9
1.1 1.2 1.3 1.4
2.1 2.2 2.3 2.4
3.1 3.2 3.3 3.4
4.1 4.2 4.3
5.1 5.2 5.3 5.4
PERFORMANCE OBJECTIVE

Fig. 7

despite the similarities in profiles, important differences exist between the groups in mean age equivalency scores. For example, among normal children, self-identification (1.1) received the highest age equivalency scores on the Socialization subscale while among the sensorily impaired groups, responding to other (1.2) received the highest score. In Motor Development, the hearing impaired group scored unusally low on the performance objective concerned with balance (3.1) and in Perceptual Abilities, differences between the groups accurately reflected the sensory impairments characteristic of the group. Finally, in Language Development, it is apparent that while the receptive language objective (5.2) is low for all groups due to the maximum attainable age equivalency score of 12 months, the relatively low expressive language scores (5.3) with respect to other Language Development objectives is probably real since normal children score relatively high on this objective.

The data in Figure 7 also reveal some difficulties in interpretation of age equivalency scores. Since the mean chronological age of the unimpaired children is 28 months, one might expect to see the mean age equivalency scores centered around 28. However, in only one performance objective (2.1) excluding objective 5.2, did the mean score fall below 28. This may be at least partially due to sample bias since the normal children were of middle and upper middle class backgrounds. However, the broad range of mean age equivalency scores across performance objectives on each subscale and across the entire scale suggests that the age equivalency

scores are not directly comparable to chronological age. It should be noted, though, that the largest sample (deaf-blind) showed the least variation in age equivalency scores across performance objectives. A full determination of the usefulness of mean age equivalency scores, therefore, must await a more systematic attempt to gather normative data.

DISCUSSION

The current study indicates that the Azusa Scale is a quantifiable developmental check-list which is easy to administer and provides information useful for planning and evaluating programs for deaf-blind children both at the level of the individual child and at the level of the total program of services. Azusa Scale profiles such as those shown in Figures 1 and 2, for example, point out to the teachers specific areas where progress was and was not made in the course of the school year by the child. These findings can be used by the teachers to measure the effectiveness of specific teaching and rehabilitative techniques and to aid in future planning of developmentally appropriate programs. Mean age equivalency scores, obtained by summing the age equivalency scores across children for each subscale and each performance objective, provide evidence that the Callier program was particularly successful in inducing developmental progress among deaf-blind children and that some progress occurred in all behavioral areas (Figure 4; Tables I, III, IV).

Subscale mean age equivalency data for individual children (Table I) indicate that while the areas of behavior evidencing greatest and least developmental advancement differed between children, most children made some progress in all areas, and no

children regressed to lower levels. Greatest progress tended to occur in Perceptual Abilities while least progress most commonly took place in Language Development (Table II).

In terms of group mean age equivalency scores (Table I), 15 months progress occurred in Perceptual Abilities and 14 months progress in Socialization during the mean 7 month inter-test interval. Minimum development on any subscale was 9 months and occurred in Language Development.

Mean age equivalency data for the total group with respect to the individual performance objectives again indicates substantial developmental progress in nearly all areas of behavior (Table III). In Socialization, nearly equal progress occurred on the four performance objectives, although pre- and post-test mean age equivalency scores differed markedly. Progress also took place in all areas of Daily Living Skills but was most evident in eating and toileting. In Motor Development, greatest progress took place in fine motor control while gross motor skills were at a higher level pre- and post-test. Substantial progress was also noted in Perceptual Abilities, particularly in the use of tactile and auditory stimuli although use of the auditory modality was observed to be extremely low. Finally, in Language Development, progress occurred in all areas, but expressive and receptive language were very low both pre- and post-test.

The mean age equivalency data indicate that in all but one performance objective, the group of children as a whole made developmental progress at least equal to the time interval in

months separating the pre- and post-tests. This finding suggests that the deaf-blind children in the Callier program progressed at a rate greater than would be expected from normally developing children. Unfortunately, however, the unimpaired children to whom the Azusa Scale was administered have not yet been re-tested. Thus, it is not known whether they will show age equivalency changes only equal to the actual inter-test interval. Nonetheless, the results suggest that the deaf-blind children in the Callier program are beginning the process of "catching up" to their normally developing peers.

The Azusa Scale has been used once previously to assess progress among multihandicapped and deaf-blind children. The previous study, conducted by Thomas (1) at the East San Gabriel Valley School for Multi-Handicapped Children in Azusa, California, produced some differences in findings from those obtained at Callier. The primary differences between the two programs were in the subscale areas showing greatest and least developmental progress. At the East San Gabriel Valley School, greatest gains were reported in Language Development and least progress in Perceptual Abilities while for Callier, greatest gains were in Socialization and Perceptual Abilities and least progress in Language Development.

The differences between programs are in part due to the fact that the data from the East San Gabriel Valley School were presented

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(1) Thomas, I. J. Phase 5: Dissemination of an Educational Program for Multihandicapped Children, Office of the Los Angeles County Superintendent of Schools, Division of Special Education, 1972.

as mean level score while those for the Callier Program were presented as mean age equivalency. When the Callier data are converted to mean level scores, the results are more similar (Table VII). For example, if one ranks the pre- and post-test subscale scores within each program, it is evident that except for Socialization, highest and lowest functioning levels are in essentially the same areas for both programs. Overall, however, the children at the East San Gabriel Valley School tend to be functioning at a higher level. Maximum and minimum progress as measured by mean level differences also occurred in essentially the same areas for both programs, although greater progress overall appeared to take place among Callier children.

The differences in estimates of progress depending on the type of mean data used (mean level or mean age equivalency) must be resolved before valid conclusions can be reached concerning actual developmental advancement among the children. However, it appears that mean age equivalency scores are the most meaningful method of reducing the data since they permit developmental change to be equated both between and within performance objectives. This is important since the structure of the Azusa Scale required that greater developmental advances be made in order to show progress at higher levels than at lower levels on the scale. Thus, mean level scores tend to penalize programs serving higher functioning children. The more limited progress among the East San Gabriel Valley School children compared to the Callier children with respect to mean level score may therefore be due to the initially

TABLE VII

Pre- and Post-Test Mean Level Scores

	ESGVS*					CALLIER				
Subscale	Pre	Rank	Post	Diff.	Rank	Pre	Rank	Post	Diff.	Rank
Socialization	3.54	2	4.37	0.83	2	1.94	5	3.36	1.42	1
Daily Living Skills	3.30	4	4.07	0.77	3	2.78	3	3.92	1.14	4
Motor Development	3.64	1	4.38	0.74	4	3.73	1	4.53	0.80	5
Perceptual Abilities	3.45	3	4.18	0.73	5	2.86	2	4.06	1.20	3
Language Development	2.93	5	3.87	0.94	1	1.97	4	3.25	1.28	2
Overall Mean	3.37		4.17	0.80		2.66		3.82	1.16	

*Thomas, J. J. Phase 5: Dissemination of an Educational Program for Multi-Handicapped Children. Office of the Los Angeles County Superintendent of Schools Division of Special Education, 1972, p. 6.

higher functioning level of the East San Gabriel Valley School children (Table VII). In fact, the Callier children made least progress in Motor Development, the subscale on which they scored highest in the pre-test.

Although mean age equivalencies appear preferable to mean level scores for the interpretation of progress, there are several potential problems inherent in their use. One problem is that for consistency in this study only the minimum age equivalency provided on the scale was considered in calculating the mean age equivalency. Thus, the mean score may be somewhat lower than would be expected in normal development. However, the results from the sample of unimpaired children (Figure 7) suggest that, if anything, the age equivalencies provided on the scale were too high since the mean age equivalency scores of the unimpaired children were generally well above their mean chronological age (Figure 7). Another problem is that in some cases, advancement in developmental level was not reflected in the age equivalency score since the same minimum age equivalency occurred for more than one level in the developmental sequence. This problem can often be avoided by using the midpoint of the age equivalency range for attainment of that particular level. This would, however, tend to increase the likelihood of demonstrating progress between pre- and post-tests, and it was felt that, at this time, it would be preferable to retain a conservative bias in order to be more confident of findings which indicated substantial developmental progress among the children.

Findings from region-wide administration of the Azusa Scale provide preliminary information concerning the characteristics of the population of deaf-blind children served. A comparison of pre-test results from major programs indicate that the profiles made up of the mean performance objectives are markedly similar (Figures 5 and 6). This suggests that the children within each program exhibit basically similar developmental characteristics, although the children may be functioning on different overall developmental levels.

Inter-program differences in Azusa Scale profile configurations, when they appear, are often relatable to the specific emphasis or lack of emphasis within programs on particular areas of development. For example, only the Callier children exhibit a mean age equivalency score for feeding which exceeds the score for all other Daily Living Skills performance objectives (Figure 5). This probably reflects the emphasis and success (Table III) of the Callier program in developing feeding skills. In other cases, profile differences particularly in Motor Development and Perceptual Abilities are probably related to the type and extent of handicap most prevalent among children in the program although there has not yet been an opportunity to compare the Azusa Scale data with the medical records of individual children.

While the configuration of the Azusa Scale profiles are similar between programs, marked and consistent inter-program differences do exist in the age equivalency scores for individual performance objectives (Figures 5 and 6). These results suggest, for example, that children in the Oklahoma City Child Study Center are at a

higher developmental level than children in other deaf-blind programs in the Region. They also indicate that children at Pinecrest State School and the Arkansas Children's Colony tend to be at lower levels. These differences most likely reflect the extent of handicaps among the children and possibly the degree of exposure of these children to educational and rehabilitative programs. Such findings may, therefore, have implications for region-wide implementation of specific educational and rehabilitative programs.

Progress on a regional basis has not been determined since post-test data are not yet available. Post-test results will, however, provide useful information concerning the extent of developmental progress to be expected among children in the various types of programs. This information, too, when compared with information concerning characteristics of the children served may have implications for the introduction of specific techniques region-wide.

Completion of the Azusa Scale post-test will also provide data on a sufficiently large sample of deaf-blind children to permit an attempt at answering questions concerning progress among subgroups of deaf-blind children. Thus, it may be possible to determine the effect of intensive educational, rehabilitative, and therapeutic intervention on children exposed to programs for the first time. It is of interest, for example, to know if the rate of developmental progress in the first year is followed by a leveling-off or an acceleration in subsequent years or if, in fact, development in the first year in a program is at all predictive of future developmental advancement.

Other questions which may be answered concern the prognosis for developmental progress as a function of etiology, type, and severity of handicaps, as well as the value of early intervention and the particular programming most effective for specific subgroups of deaf-blind children. The data will also comprise a region-wide registry of deaf-blind children with respect to developmental level and developmental progress in discrete behavioral areas. This information will permit specific subgroups of children to be pinpointed for the application of specific educational techniques and services and for identification and inclusion in future research studies.

There is one major drawback to the use of the Azusa Scale; its usefulness for measuring progress is limited to a developmental age equivalency of 5 or 6 years. Thus, the scale is of less value for individual higher level children and for programs serving primarily higher level children. It is hoped, however, that in the future the scale will be expanded so that abilities developed by normal children at an age older than 5 or 6 years will be included. When this is done, the Azusa Scale will become even more applicable as a tool for evaluating developmental progress.

In summary, the Azusa Scale appears to be a useful device for measuring developmental progress particularly among highly involved multihandicapped children. The current experience in administering the Azusa Scale and in analyzing the results indicates that important information can be gathered and interpreted in a minimum of time. This permits rapid application of the findings to

bring about improvements in programming for individual children as well as for identifying the strengths and weaknesses of a program as a whole. The data also provide documentation that the 16 children in the Callier Deaf-Blind Program made significant developmental progress in all behavioral areas during the course of the 1971-72 school year. The extent of progress suggests that these children are beginning to catch up with their normally developing peers.